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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

SEPPÖ LAINE OY
Itämerenkatu 3 B
FIN-00180 Helsinki
FINLANDE

Date of mailing (day/month/year) 30 August 2001 (30.08.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference VAL 227 PCT	
International application No. PCT/FI00/00817	International filing date (day/month/year) 22 September 2000 (22.09.00)

1. The following indications appeared on record concerning:

☒ the applicant ☒ the inventor ☐ the agent ☐ the common representative

Name and Address

LEPPÄKOSKI, Helena
Sirukuja 6
FIN-04440 Järvenpää
Finland

State of Nationality

FI

State of Residence

FI

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☐ the name ☒ the address ☐ the nationality ☐ the residence

Name and Address

LEPPÄKOSKI, Helena
Sirukuja 6
FIN-0440 Järvenpää
Finland

State of Nationality

FI

State of Residence

FI

Telephone No.

Facsimile No.

Teleprinter No.

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The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Catherine MASSETTI Telephone No.: (41-22) 338.83.38
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NOTIFICATION OF THE RECORDING
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SEPPO LAINE OY
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FIN-00180 Helsinki
FINLANDE

Date of mailing (day/month/year) 12 June 2001 (12.06.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference VAL 227 PCT	
International application No. PCT/FI00/00817	International filing date (day/month/year) 22 September 2000 (22.09.00)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor	<input type="checkbox"/> the agent
<input type="checkbox"/> the common representative		
Name and Address VALMET CORPORATION Fabianinkatu 9 A FIN-00130 Helsinki Finland	State of Nationality FI	State of Residence FI
	Telephone No. +358-20 484 100	
	Facsimile No. +358-20 484 101	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
<input type="checkbox"/> the person	<input checked="" type="checkbox"/> the name	<input type="checkbox"/> the address
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Name and Address METSO PAPER, INC. Fabianinkatu 9 A FIN-00130 Helsinki Finland	State of Nationality FI	State of Residence FI
	Telephone No. +358-20 484 100	
	Facsimile No. +358-20 484 101	
	Teleprinter No.	
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Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
29 March 2001 (29.03.2001)

PCT

(10) International Publication Number
WO 01/21888 A1

(51) International Patent Classification⁷: **D21G 1/00**

(21) International Application Number: **PCT/FI00/00817**

(22) International Filing Date:
22 September 2000 (22.09.2000)

(25) Filing Language: **Finnish**

(26) Publication Language: **English**

(30) Priority Data:
19992058 24 September 1999 (24.09.1999) **FI**

(71) Applicant (for all designated States except US): **VALMET CORPORATION [FI/FI];** Fabianinkatu 9 A, FIN-00130 Helsinki (FI).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **LEPPÄKOSKI, Helena [FI/FI];** Sirukuja 6, FIN-04440 Järvenpää (FI).

KOIVUKUNNAS, Pekka [FI/FI]; Tupalantie 13 D 31, FIN-04400 Järvenpää (FI). **HASANEN, Kari [FI/FI];** Päivärinteentie 13 A 6, FIN-04250 Kerava (FI).

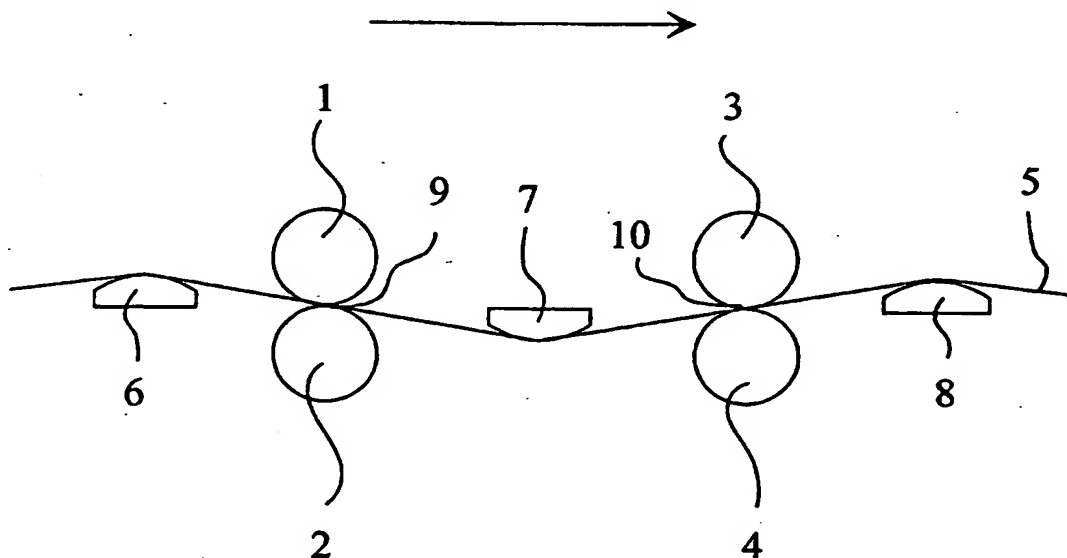
(74) Agent: **SEPPO LAINE OY;** Itämerenkatu 3 B, FIN-00180 Helsinki (FI).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,

[Continued on next page]

(54) Title: **METHOD AND ASSEMBLY FOR OPENING CALENDER NIPS**



(57) Abstract: The present invention relates to a method and assembly for opening the nips (9, 10) of a calender comprising at least two elements (1, 2; 3, 4) brought to a nip contact with each other, especially for performing the nip opening at a break or damage occurring in the web (5) being calendered. The tension of the web (5) being calendered is measured at multiple points over the cross-machine width of the web (5) and the calender nips (9, 10) are opened when the measured web tension at a preset number of points over the cross-machine width of the web (5) has fallen to a limit value that by a decision-making algorithm monitoring the tension profile of the web (5) is interpreted to indicate a web break situation or other damage on the web (5) requiring opening the nips (9, 10).



IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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Published:

— *With international search report.*

Method and assembly for opening calender nips

The present invention relates to a method according to the preamble of claim 1 and an assembly according to the preamble of claim 7 for opening calender nips especially at breaks occurring in a web being calendered. The invention also relates to a method according to the preamble of claim 14 for detecting a break in a moving web.

Conventionally, the surface of a moving web of paper or board is smoothed and made glossy in a multiroll calender comprising a plurality of rolls stacked in a calender frame so as to form a nip contact with each other. A multiroll calender comprises a top roll and a bottom roll with at least one intermediate roll located therebetween. The rolls of the stack are compressed against each other by the top and bottom rolls that act as the loading rolls to provide a sufficiently high linear nip force. In calendering, the web passes through the calender nips formed by the superimposed rolls. A soft-roll calender typically has two or four nips placed in a succession in separate calender frame sections thus allowing the web being calendered to pass straight between two successive nips. In a conventional two-nip soft-roll calender, the web is calendered once on either side.

Some of the calender rolls are heatable, hard-surfaced thermorolls, while some others are rolls surfaced with a soft coating. For instance, one of the rolls in a roll pair of a soft-roll calender is generally a metal-surfaced thermoroll and the other is soft-coated roll. The thermoroll is typically heated with oil or some other

heat-transfer medium such as water or steam. Using oil as the heating medium, a roll temperature of almost 300 °C can be reached. However, the temperature of the thermoroll is typically about 200 °C. Circulation of the heat-transfer medium in the roll can be accomplished in different ways. The most frequently employed technique is to feed the heat-transfer medium into and out from the roll via a single end only, whereby the medium first is passed along one duct to the roll end and then the return flow takes place along a parallel duct. The return flow exits the roll to a reheating circuit via a bore made to the roll end flange and the roll shaft.

In the material selection for soft-coated rolls, the possible temperature elevation caused by an adjacent thermoroll must be taken into account. The surface coverings of soft-coated rolls are selected from the group of materials compatible with the rugged conditions imposed by the nip contact, such as a generally available polymer of the thermosetting or thermoplastic type, for instance. Rolls coated with a thermoplastic polymer are described in, e.g., publication GB 1,011,114, while rolls coated with a thermosetting polymer are described in, e.g., publication EP 321,561. In the prior art it was conventional to make the covering of soft-coated rolls from natural-fiber-based materials such as those described in, e.g., publication US 4,283,821.

As the web being calendered may in some cases break during calendering, either prior to or after the calendering step, it is necessary to have an ability to open the calender nips as rapidly as possible at the occur-

rence of a web break. Opening the nips is particularly important in calenders having soft-coated rolls. Namely, the thermorolls of closed nips begin after the web break to heat the adjacent soft-coated rolls because there is
5 no more a paper web running through the nip so as to remove the heat emitted by the thermorolls. Herein, the soft-coated rolls may overheat resulting in a roll damage. In modern calenders running at high web speeds, also the amounts of heat transferred to the thermorolls
10 may be substantially large, which means that an extremely rapid opening of a thermoroll nip is mandatory, even as fast as in few tenths of a second if the web break occurs just upstream from a nip.

15 To prevent damage to soft-coated rolls, calenders are equipped with automatic web-breakage control that opens the calender nips immediately at a web break. Typically, the occurrence of web breaks is monitored by means of photocell curtains installed over the web in the cross-
20 machine direction. As the detection of a web break must take place in a short time, it is not possible to apply a sufficient filtration to the output signal obtained from the photocells. Hence, a small defect, such as a hole in the web, may be interpreted as a web break even if the
25 defective portion of the web in fact might pass the calender without problems. However, due to the high price of the soft-coated rolls, it is customary to set the control system to open the nips already at the occurrence of the smallest defects. As a consequence of such an
30 erroneous or oversensitive response of the automatic web-breakage control system, the calender nips are opened, which is an ultimate cause to an actual web break.

It is an object of the present invention to overcome the problems of the above-described prior art and to provide an entirely novel method and assembly suited for opening the nips of a calender passing a web being calendered at the instant a web break or damage is detected. It is a further object of the invention to provide an entirely novel method for detecting a break in a moving web.

10 The goal of the invention is achieved by way of measuring the tension profile of the web being calendered at multiple points over the cross-directional width of the web, whereby a proper processing of the measurement signal makes it possible to categorize a detected defect as an actual web break necessitating the opening of the nips or as a damaged surface area or minor defect of the web that may be assumed to pass the calender without major problems. The web tension profile may be measured, e.g., by arranging the moving web to pass over an arcuate tension gauging bar. The tension gauging bar is provided with holes communicating with sensors mounted at the holes so that the local pressure of the air cushion formed between the moving web and the gauging bar can be measured. The pressure of the air cushion at a given point is proportional to the web tension at said point. The calender nips are opened when the web tension at a preset number of points over the cross-machine width of the web has fallen to a value at which the decision-making algorithm monitoring the overall tension profile of the web interprets the situation as a web break or an extensive defect on the web that requires the opening of the nips. The web tension may be measured, e.g., in front

of the calender, after the calender or between two nips thereof.

More specifically, the method according to the invention
5 for opening the nips of a calender is characterized by
what is stated in the characterizing part of claim 1.

The assembly according to the invention for opening the
nips of a calender is characterized by what is stated in
10 the characterizing part of claim 7.

Furthermore, the method according to the invention for
detecting breaks in a running web is characterized by
what is stated in the characterizing part of claim 14.

15

The invention offers significant benefits.

By way of monitoring the cross-machine tension profile of
the web being calendered, it is possible to discriminate
20 web breaks and other major defects from such minor
defects that can be expected to pass the calender without
problems in a manner significantly more reliable than
what can be attained through the use of photocells. By
the same token, web breaks induced by an incorrect
25 interpretation of web monitoring signals are reduced,
thus contributing to a higher availability of the
calender and reduced amount of broke. In the embodiment
according to the invention, it is possible to define
optimally the area of maximum web damage, and the respec-
30 tive tension profile, that still permits the respective
portion of the web to be passed through the calender
without encountering major problems. Moreover, it is

possible to detect the damaged portion of the web by virtue of the web tension profile measurement before the web is passed through the calender, thus giving a highly reliable technique of opening the nips before damage is caused to the soft-coated rolls. As the preset web tension monitoring values triggering the opening of the nips can be easily changed, the arrangement according to the invention is easily applicable to different paper grades. Furthermore, the apparatus used for web tension measurement has a relatively simple construction that can be easily adapted to operate in conjunction with an existing calender.

In the following, the invention will be examined in greater detail by making reference to the appended drawing representing diagrammatically a two-nip calender.

Referring to the drawing, the calender construction shown therein comprises two nips 9, 10 formed by members brought into a nip contact, such as rolls and/or the shoes of a shoe press. In the embodiment illustrated in the drawing, the nip 9 is formed by rolls 1, 2 and the nip 10 is formed by rolls 3, 4. Typically, one of the rolls 1-4 forming the nips 9, 10 is a hard-surfaced thermoroll heated by oil, steam or water, while the other roll of the nip is a soft-coated roll. In a conventional two-nip calender, the web 5 is passed almost straight through the nips 9, 10. As the pressure imposed thereon causes the web 5 to increase in width in the first nip 9, there are conventionally placed a number of guide and spread rolls between the nips 9, 10 so that the web 5 can be spread and tensioned. Generally, the rolls 1-4 of a

soft-roll calender are arranged so that the web 5 passing the nips 9, 10 can be calendered on both sides, whereby the hard-surfaced and the soft-coated roll 1, 2 of the first nip 9 are placed in a reversed order in regard to that of the rolls 3, 4 of the second nip 10. In the drawing, the travel direction of the web 5 is denoted by an arrow.

In the travel direction of the web 5 being calendered, at a point preceding the first nip 9, there is placed a gauging device 6 that measures the cross-machine tension profile of the web 5. A similar gauging device 7, 8 is also placed at a point between the nip 9 and the next nip 10, as well as to a point downstream from the nip 10 in the travel direction of the web 5. Alternatively, the gauging device can be located at only one or two of the above-mentioned points, whereby the gauging device is most advantageously placed upstream from the nips 9, 10 in regard to the travel direction of the web 5.

20

The device 6, 7, 8 measuring the tension profile of the web being calendered may be, e.g., an arcuate sensor bar incorporating a plurality of holes aligned in a row essentially at right angles in regard to the web travel direction, each one of the holes having a separate pressure sensor communicating therewith. The web 5 being calendered passes over the sensor bar 6, 7, 8 supported by an air cushion that is formed when the boundary air layer entrained with the web 5 is compressed between the sensor bar 6, 7, 8 and the web 5. The cross-machine tension profile of the web 5 can be determined by way of measuring the local pressure between the running web 5

30

and the arcuate section of the sensor bar 6, 7, 8 by means of the pressure sensors communicating with the holes of the sensor bar 6, 7, 8. Obviously, at points where the web 5 is broken or the web 5 has a hole, there cannot be formed any air cushion or, if an air cushion exists, its pressure is lower than at an intact point of the web 5. The structure of one such embodiment of a gauging bar 6, 7, 8 is described, e.g., in more detail in patent publication US 5,052,233.

10

The nips 9, 10 of the calender are opened when the web tension measured at a desired number of cross-machine points of the web 5 have fallen to a limit value at which the decision-making algorithm monitoring the tension profile of the web 5 interprets the situation to be a web break or a so extensively damaged area of the web 5 that requires the opening of the nips 9, 10. Herein, a cross-machine point of the web 5 must be understood to refer to a measurement area monitored by a single sensor or an area of the cross-machine width of the web 5 defined by any other method. When a decision must be made to open the nips 9, 10, it is not necessary to detect an almost complete break of the web 5, but instead, it is generally sufficient to detect a larger defect than that represented by a minor hole in the web 5 or a ragged edge of the web 5.

25

The decision-making algorithm of the above-described method can be implemented by way of, e.g., giving the cross-machine tension of the web 5 a reference value to which the tension values sensed by the gauging devices 6, 7, 8 are compared. The widths of the areas on the web 5

30

at the points, where the measured value of the web tension fall below the preset reference value, are summed. Next, the summed width of the defective areas over the cross-machine width of the web 5 falling short of the preset reference value is compared to the overall width of the web 5, whereby any violation of an adjustably-defined preset limit value of damaged area triggers the opening of the nips 9, 10. In other words, the summed width of the areas detected in the web 5 falling short of the preset limit value are herein considered to represent the width of the damaged area in the web 5. For instance, if the web 5 being calendered breaks entirely, the measured tension of the web falls below the preset reference value at least essentially over the entire width of the web 5. Experimental data can be used in the determination of the reference value and the limit value representing the maximum summed width of the damaged areas to the overall width of the web 5 that may be assumed to pass the web 5 through the calender without problems. Generally, there must be determined different reference and limit values for each one of the paper grades to be produced. Obviously, it is necessary to provide possibilities of changing the settings of the reference and limit values when the properties of the paper web being calendered vary.

Another technique of setting up the decision-making algorithm is to compute, e.g., a weighted average of the measurement values obtained from the different points over the cross-machine width of the web and then to open the nips 9, 10 when this value falls below the preset reference value. Typically, the weighing factor in the

averaging computation is set proportional to the width of the measurement point in question.

The decision-making algorithm may also be designed to
5 implement the above-described functions in a more intelligent manner utilizing, e.g., a model based on statistical analysis that takes into account, e.g., the magnitude of the normal variations in the web tension and makes an inference on a web break when the tension measurement
10 values taken on the web 5 fall significantly below those expected to be encountered within the random variations of normal tension measurement data.

The method according to the invention for detecting a
15 break in the web 5 is otherwise similar to the above-described method for opening calender nips, except that herein an indication of a web break is triggered when in the web 5 the summed width of the areas at which the measured tension value of the web 5 falls below a preset
20 reference value becomes at least essentially equal to the overall width of the web 5.

In addition to those described above, the invention may have alternative embodiments.

25

In spite of the fact that the above arrangement using a gauging sensor bar for determining the cross-machine tension profile of the web being calendered can be appreciated as the most preferred embodiment of the invention,
30 also other kinds of equipment suited for the task can be used. One kind of such apparatuses is a tension measurement roll axially divided in segments having the air-

cushion pressure gauging sensors adapted therein.

As it may be difficult to adapt the web tension measuring equipment into the space remaining between the calender nips in multiroll calenders comprising a plurality of
5 nips formed by superposed rolls, the measurement of the cross-machine web tension profile must in practice be performed either upstream and/or downstream of calender.

10 After the decision-making algorithm has detected a web break or a defective point on the web 5, the web 5 may be severed by means of an air-jet cutting device that cuts the web with the help of a compressed-air jet. After the web has been cut with the help of the compressed-air jet,
15 the web 5 can be guided away from the nips to prevent the web from becoming wound about the calender rolls. In practice, the cutting technique based on an air jet is much safer than a web-cutting technique implemented with cutting knives, for instance. The air-jet cutting
20 apparatus may be integrated, e.g., in the above-described web tension gauging bar.

Claims:

1. Method for opening the nips (9, 10) of a calender comprising at least two elements (1, 2; 3, 4) brought to a nip contact with each other, especially for performing the nip opening at a break or damage occurring in the web (5) being calendered, in which method the tension of the web (5) being calendered is measured at multiple points over the cross-machine width of the web (5), characterized in that the calender nips (9, 10) are opened when the measured web tension at a preset number of points over the cross-machine width of the web (5) has fallen to a limit value that by a decision-making algorithm monitoring the tension profile of the web (5) is interpreted to indicate a web break situation or other damage on the web (5) requiring opening the nips (9, 10).
2. Method according to claim 1, characterized in that
- a reference value is set for the tension of the web (5) measured at a point over the cross-machine width of the web,
 - said measured tension value of the web (5) is compared with said reference value, and
 - the calender nips (9, 10) are opened when the ratio of the areas, at which the measured tension values of the web (5) fall below a

preset reference value, as summed over the cross-machine width of the web (5), to the overall width of the web (5) exceeds a preset limit value.

5

3. Method according to claim 1, c h a r a c t e r -
i z e d in that

10

- a preset reference value is set for the tension of the web (5) measured at a point over the cross-machine width of the web,

15

- a weighted average is computed from said measured tension values of the web (5) obtained from different points over the width of the web, and

20

- the calender nips (9, 10) are opened when said weighted average of the web tension values falls below the preset reference value.

4. Method according to claim 3, c h a r a c t e r -
i z e d in that the width of the detected area is used as the weighing factor of said weighted average.

25

30

5. Method according to any one of foregoing claims, c h a r a c t e r i z e d in that the tension of the web (5) being calendered is measured indirectly by way of measuring the pressure of an air cushion formed between the moving web (5) and a gauging bar, which is located in a close proximity to said web (5) and has an at least partially arcuate shape in

the travel direction of said web (5), whereby the measured pressure of said air cushion is proportional to the tension of said web (5).

5 6. Method according to any one of foregoing claims,
c h a r a c t e r i z e d in that the web (5) being
calendered is severed with the help of an air-jet
cutting device when a decision-making algorithm
monitoring the tension profile of said web (5)
10 interprets the detected situation to be caused by a
web break or other damaged area of the web (5) that
necessitates the opening of the nips (9, 10).

15 7. Assembly for opening calender nips (9, 10), partic-
ularly at the occurrence of a break or damage in a
web (5) being calendered, said assembly comprising

- at least two members (1, 2; 3, 4) adapted to
cooperate in a nip contact so as to pass there-
20 between the web (5) being calendered, and
- a gauging device (6, 7, 8) for measuring the
tension of the web (5) being calendered at
multiple points along the cross-machine width of
25 the web (5),

c h a r a c t e r i z e d in that the calender nips
(9, 10) are adapted openable when the web tension
measured at a preset number of cross-machine points
30 of the web (5) has fallen to a value at which a
decision-making algorithm monitoring the tension
profile of the web (5) interprets the detected

situation to be caused by a web break or other damaged area of the web (5) that necessitates the opening of the nips (9, 10).

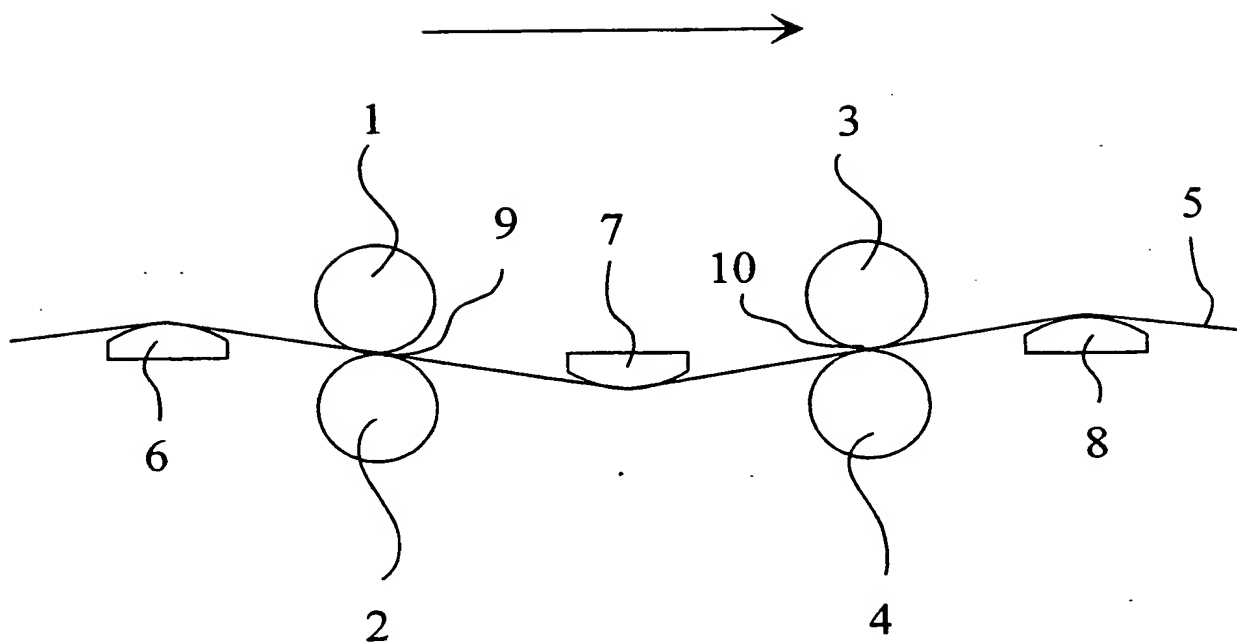
- 5 8. Assembly according to claim 7, c h a r a c t e r -
i z e d in that said gauging device (6, 7) is
located at a point preceding said calender nip (9,
10) upstream in regard to the travel direction of
the web (5).
- 10 9. Assembly according to claim 7 or 8, c h a r a c -
t e r i z e d in that said gauging device (8) is
located at a point after said calender nip (9, 10)
downstream in regard to the travel direction of the
15 web (5).
10. Assembly according to any one of claims 7-9,
c h a r a c t e r i z e d in that said gauging
device (6, 7, 8) is a gauging bar shaped to have an
20 at least partially arcuate surface in the travel
direction of said web (5) and has pressure sensors
adapted to holes made thereon.
11. Assembly according to any one of foregoing claims,
25 c h a r a c t e r i z e d in that one of the
members (1, 2; 3, 4) forming said calender nip (9,
10) is metal-surfaced roll and the other one is
soft-coated roll.
- 30 12. Assembly according to any one of foregoing claims,
c h a r a c t e r i z e d by an air-jet cutting
device adapted to perform the severing of said web

(5) being calendered at the instant the decision-making algorithm monitoring interprets the situation to be a web break or a so extensively damaged area of the web (5) that requires the opening of the nips (9, 10).

13. Assembly according to claim 12, characterized in that said air-jet cutting device is integrated with said web tension gauging bar.

14. Method for detecting a break or damage occurring in a web (5) being calendered, in which method the machine-direction tension of the web (5) being calendered is measured at multiple points over the cross-machine width of the web (5), characterized in that a break or damage of the web (5) is indicated when the measured web tension at a preset number of points over the cross-machine width of the web (5) has fallen to a limit value that by a decision-making algorithm monitoring the tension profile of the web (5) is interpreted to indicate a web break situation or other damage on the web (5) requiring opening the nips (9, 10).

1/1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00817

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21G 1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 29902451 U1 (VALMET CORP.), 8 July 1999 (08.07.99) --	1-12,14
Y	US 5052233 A (ESKO RANTALA), 1 October 1991 (01.10.91) --	1-12,14
A	US 4799997 A (ROBERT H. THOMPSON), 24 January 1989 (24.01.89) --	1-14
A	US 4485734 A (PAUL J. KLEMMER ET AL), 4 December 1984 (04.12.84) -- -----	1-14

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

20 December 2000

Date of mailing of the international search report

10-01-2001

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Erika Aspeby/ELY
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

04/12/00

International application No.
PCT/FI 00/00817

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
DE	29902451	U1	08/07/99	AT	3330 U	25/01/00
				JP	2000178892 A	27/06/00
				SE	9804346 D	00/00/00

US	5052233	A	01/10/91	AT	99416 T	15/01/94
				CA	1321893 A	07/09/93
				DE	68911862 D,T	19/05/94
				EP	0367901 A,B	16/05/90
				SE	0367901 T3	
				ES	2048240 T	16/03/94
				FI	80522 B,C	28/02/90
				FI	884236 D	00/00/00
				JP	2114141 A	26/04/90
				JP	2644047 B	25/08/97
				PT	91706 A,B	30/03/90

US	4799997	A	24/01/89	NONE		

US	4485734	A	04/12/84	CA	1230510 A	22/12/87
				EP	0120663 A	03/10/84
				FI	841173 A	25/09/84
				JP	59187695 A	24/10/84

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

SEPPO LAINE OY
Itämerenkatu 3 B
FIN-00180 Helsinki
FINLANDE

Date of mailing (day/month/year) 12 June 2001 (12.06.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference VAL 227 PCT	
International application No. PCT/FI00/00817	International filing date (day/month/year) 22 September 2000 (22.09.00)

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address VALMET CORPORATION Fabianinkatu 9 A FIN-00130 Helsinki Finland	State of Nationality FI	State of Residence FI
	Telephone No. +358-20 484 100	
	Facsimile No. +358-20 484 101	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☒ the name ☐ the address ☐ the nationality ☐ the residence

Name and Address METSO PAPER, INC. Fabianinkatu 9 A FIN-00130 Helsinki Finland	State of Nationality FI	State of Residence FI
	Telephone No. +358-20 484 100	
	Facsimile No. +358-20 484 101	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer F. Baechler Telephone No.: (41-22) 338.83.38
---	---

Patent- och registreringsverket
Box 5055
S-102 42 Stockholm
Sverige

29 October 2001

VIITTEENNE:
YOUR REFERENCE:

TELEFAX AND MAIL
(8 pages)

VIITTEEMME:
OUR REFERENCE:

VAL 227 PCT

INTERNATIONAL PATENT APPLICATION NO. PCT/FI00/00817,
in the name of METSO PAPER, Inc. et al

Dear Sirs,

Referring to the written opinion of 29 August 2001 we respectfully submit the following:

Amendments:

We enclose new pages 12 to 16, which replace pages 12 to 16 presently on file.

New independent claims 1, 7 and 14 replace the original corresponding independent claims.

New claim 1 differs from the original claim in that the feature "web breaking situation" has been removed and the feature "the decision to open the nips is made before a complete break of the web (5) occurs" has been added to the characterizing part of the claim.

SEPPÖ LAINE OY

PL 339 P.O.B. 339
00181 HELSINKI, FINLAND

TOIMISTO-OFFICE
ITÄMERENKATU 3 B
00180 HELSINKI, FINLAND

* SUOMEN PATENTTIASIAMIESYHDISTYS
RY:N JÄSEN

* MEMBER OF FICPI
* MEMBER OF EPI
* OHIM REPRESENTATIVE



PUHELIN PHONE
NAT. 09-68 59 560
INT. + 358 - 9-68 59 560
FAX + 358 - 9-68 595610

SÄHKÖPOSTI E-MAIL
seppo.laine@seipat.fi

VAT No. FI 05905255
REG.No. 342.419

PANKKI BANK
MERITA (SW: MRITFIHH)
215318-60138

POSTISIIRTO POSTGIRO
800018-1108516

New claim 7 differs from the original claim in that the feature "web breaking situation" has been removed and the feature "the decision to open the nips is made before a complete break of the web (5) occurs" has been added to the characterizing part of the claim.

New claim 14 differs from the original claim in that the feature "web breaking situation" has been removed from the characterizing part and the feature "the indication is made before a complete break of the web (5) occurs" has been added to the characterizing part of the claim.

The amendments of the claims are based on the subject matter on page 8 in lines 11 to 26 of the description.

No new material has been added.

Patentability:

The invention defined in the new claims relates to a web monitoring system in which the web tension is monitored and the calender nips are opened when the measured web tension at a preset number of points over the cross-machine width of the web has fallen to a limit value that by a decision-making algorithm monitoring the tension profile of the web is interpreted to indicate a damage on the web requiring opening the nips. In the invention the decision to open the nips is made before a complete break of the web takes place.

With the help of the invention the size of a damaged web area, which can be passed through the calender without significant problems, can be optimised. Therefore it is not necessary open the calender nips when minor damage on the web is detected or to wait until a complete web break takes place, whereby the availability of the calender increases and the possibility that the soft rolls of the calender are damaged decreases.

Cited document D1, DE 29902451, discloses a calender provided with a device which detects web breaks. The nip of the calender is opened when the web break is detected. The document suggests that any device can be used for detecting the web break and mentions optical and electromagnetic sensors as examples. The cited document D2, US 5052233, discloses a web tension measuring device which also indicates web breaks.

D2 teaches measuring the web tension in multiple positions. However this document does not refer to the use of the method for indicating loss of the web tension over a limited area across the web. According to D2 the apparatus and method can be used for indicating web breaks but the use for indicating partial damages of the web is not described. Since the indicating partial damages has almost solely use in calendering, this publication alone does not provide sufficient information for ending up to the invention. The D1 describes indicating breaks in the web before a calender. The break indicator is not described and partial damages are not mentioned. Therefore it would have been impossible to realise on the bases of teachings of D1 and D2 the importance of indicating the partial damages. Even more, after realising that, a solution to the problem

should have been accomplished. That solution, using the ability of the device of D2 to measure web tension in multiple places for indicating loss of web tension i.e. web damage over a limited area, can not be deducted from the teachings of the cited documents. Therefore the invention described in the amended claims is not obvious over the cited art and includes inventive step.

Yours faithfully,
Seppo Laine Oy

Jyrki Nissinen

Encl.: new pages 12-16

Claims:

1. Method for opening the nips (9, 10) of a calender comprising at least two elements (1, 2; 3, 4)
5 brought to a nip contact with each other, especially for performing the nip opening at a break or damage occurring in the web (5) being calendered, in which method the tension of the web (5) being calendered is measured at multiple points over the cross-
10 machine width of the web (5), c h a r a c t e r - i z e d in that the calender nips (9, 10) are opened when the measured web tension at a preset number of points over the cross-machine width of the web (5) has fallen to a limit value that by a
15 decision-making algorithm monitoring the tension profile of the web (5) is interpreted to indicate a damage on the web (5) requiring opening the nips (9, 10), the decision to open the nips is made before a complete break of the web (5) occurs.
20
2. Method according to claim 1, c h a r a c t e r - i z e d in that
 - a reference value is set for the tension of the
25 web (5) measured at a point over the cross-machine width of the web,
 - said measured tension value of the web (5) is compared with said reference value, and
30
 - the calender nips (9, 10) are opened when the ratio of the areas, at which the measured tension values of the web (5) fall below a
35 preset reference value, as summed over the cross-machine width of the web (5), to the overall width of the web (5) exceeds a preset

limit value.

3. Method according to claim 1, c h a r a c t e r -
i z e d in that

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- a preset reference value is set for the tension of the web (5) measured at a point over the cross-machine width of the web,

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- a weighted average is computed from said measured tension values of the web (5) obtained from different points over the width of the web, and

15

- the calender nips (9, 10) are opened when said weighted average of the web tension values falls below the preset reference value.

4. Method according to claim 3, c h a r a c t e r -
i z e d in that the width of the detected area is
20 used as the weighing factor of said weighted average.

5. Method according to any one of foregoing claims,
c h a r a c t e r i z e d in that the tension of
25 the web (5) being calendered is measured indirectly by way of measuring the pressure of an air cushion formed between the moving web (5) and a gauging bar, which is located in a close proximity to said web (5) and has an at least partially arcuate shape in
30 the travel direction of said web (5), whereby the measured pressure of said air cushion is proportional to the tension of said web (5).

6. Method according to any one of foregoing claims,
35 c h a r a c t e r i z e d in that the web (5) being calendered is severed with the help of an air-jet

cutting device when a decision-making algorithm monitoring the tension profile of said web (5) interprets the detected situation to be caused by a web break or other damaged area of the web (5) that necessitates the opening of the nips (9, 10).

7. Assembly for opening calender nips (9, 10), particularly at the occurrence of a break or damage in a web (5) being calendered, said assembly comprising

- at least two members (1, 2; 3, 4) adapted to cooperate in a nip contact so as to pass therebetween the web (5) being calendered, and

- a gauging device (6, 7, 8) for measuring the tension of the web (5) being calendered at multiple points along the cross-machine width of the web (5),

characterized in that the calender nips (9, 10) are adapted openable when the web tension measured at a preset number of cross-machine points of the web (5) has fallen to a value at which a decision-making algorithm monitoring the tension profile of the web (5) interprets the detected situation to be caused by damaged area of the web (5) that necessitates the opening of the nips (9, 10), the decision to open the nips is made before a complete break of the web (5) occurs.

8. Assembly according to claim 7, characterized in that said gauging device (6, 7) is located at a point preceding said calender nip (9, 10) upstream in regard to the travel direction of the web (5).

- 5 9. Assembly according to claim 7 or 8, c h a r a c -
t e r i z e d in that said gauging device (8) is
located at a point after said calender nip (9, 10)
downstream in regard to the travel direction of the
web (5).
- 10 10. Assembly according to any one of claims 7-9,
c h a r a c t e r i z e d in that said gauging
device (6, 7, 8) is a gauging bar shaped to have an
at least partially arcuate surface in the travel
direction of said web (5) and has pressure sensors
adapted to holes made thereon.
- 15 11. Assembly according to any one of foregoing claims,
c h a r a c t e r i z e d in that one of the
members (1, 2; 3, 4) forming said calender nip (9,
10) is metal-surfaced roll and the other one is
soft-coated roll.
- 20 12. Assembly according to any one of foregoing claims,
c h a r a c t e r i z e d by an air-jet cutting
device adapted to perform the severing of said web
(5) being calendered at the instant the decision-
making algorithm monitoring interprets the situation
25 to be a web break or a so extensively damaged area
of the web (5) that requires the opening of the nips
(9, 10).
- 30 13. Assembly according to claim 12, c h a r a c t e r -
i z e d in that said air-jet cutting device is
integrated with said web tension gauging bar.
- 35 14. Method for detecting a break or damage occurring in
a web (5) being calendered, in which method the
machine-direction tension of the web (5) being
calendered is measured at multiple points over the
cross-machine width of the web (5), c h a r a c -

t e r i z e d in that a damage of the web (5) is indicated when the measured web tension at a preset number of points over the cross-machine width of the web (5) has fallen to a limit value that by a decision-making algorithm monitoring the tension profile of the web (5) is interpreted to indicate a damage on the web (5) requiring opening the nips (9, 10), the indication is made before a complete break of the web (5) occurs.

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PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 19 DEC 2001

PCT

12

Applicant's or agent's file reference VAL 227 PCT	FOR FURTHER ACTION		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI00/00817	International filing date (day/month/year) 22.09.2000	Priority date (day/month/year) 24.09.1999	
International Patent Classification (IPC) or national classification and IPC ₇ D 21 G 1/00			
Applicant METSO PAPER INC. et al			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
 2. This REPORT consists of a total of 3 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 23.04.2001	Date of completion of this report 07.12.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Erika Westberg/ELY Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00817

I. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed
- ☒ the description:
pages 1-9, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☒ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages 12-16, filed with the letter of 29.10.2001
- ☒ the drawings:
pages 1, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00817

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-14</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-14</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-14</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The following documents are cited in the International Search Report:

D1: DE 29902451

D2: US 5052233

D3: US 4799997

D4: US 4485734

The cited documents represent background art.

The invention defined in claims 1-14 is not disclosed by any of these documents.

D1 discloses an arrangement for calendering a paper web, comprising two elements forming a nip. A measuring device (99) is provided preceding the nip to register any web break.

D2 describes an apparatus for the measurement of web tension. The apparatus also quickly indicates web breaks.

None of the cited documents describe that the decision to open the nips can be made before a complete break of the web occurs. No relevant combination of the cited documents would lead a person skilled in the art to the invention defined in the claims.

Therefore, the invention defined in claims 1-14 is novel and is considered to involve an inventive step. It is also considered to be industrially applicable.

Claims:

1. Method for opening the nips (9, 10) of a calender comprising at least two elements (1, 2; 3, 4) brought to a nip contact with each other, especially for performing the nip opening at a break or damage occurring in the web (5) being calendered, in which method the tension of the web (5) being calendered is measured at multiple points over the cross-machine width of the web (5), characterized in that the calender nips (9, 10) are opened when the measured web tension at a preset number of points over the cross-machine width of the web (5) has fallen to a limit value that by a decision-making algorithm monitoring the tension profile of the web (5) is interpreted to indicate a damage on the web (5) requiring opening the nips (9, 10), the decision to open the nips is made before a complete break of the web (5) occurs.
2. Method according to claim 1, characterized in that
- a reference value is set for the tension of the web (5) measured at a point over the cross-machine width of the web,
 - said measured tension value of the web (5) is compared with said reference value, and
 - the calender nips (9, 10) are opened when the ratio of the areas, at which the measured tension values of the web (5) fall below a preset reference value, as summed over the cross-machine width of the web (5), to the overall width of the web (5) exceeds a preset

limit value.

3. Method according to claim 1, c h a r a c t e r -
i z e d in that

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- a preset reference value is set for the tension
of the web (5) measured at a point over the
cross-machine width of the web,

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- a weighted average is computed from said meas-
ured tension values of the web (5) obtained from
different points over the width of the web, and

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- the calender nips (9, 10) are opened when said
weighted average of the web tension values falls
below the preset reference value.

4. Method according to claim 3, c h a r a c t e r -
i z e d in that the width of the detected area is
used as the weighing factor of said weighted
average.

20

5. Method according to any one of foregoing claims,
c h a r a c t e r i z e d in that the tension of
the web (5) being calendered is measured indirectly
by way of measuring the pressure of an air cushion
formed between the moving web (5) and a gauging bar,
which is located in a close proximity to said web
(5) and has an at least partially arcuate shape in
the travel direction of said web (5), whereby the
measured pressure of said air cushion is propor-
tional to the tension of said web (5).

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6. Method according to any one of foregoing claims,
c h a r a c t e r i z e d in that the web (5) being
calendered is severed with the help of an air-jet

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cutting device when a decision-making algorithm
monitoring the tension profile of said web (5)
interprets the detected situation to be caused by a
web break or other damaged area of the web (5) that
necessitates the opening of the nips (9, 10).

7. Assembly for opening calender nips (9, 10), particularly at the occurrence of a break or damage in a web (5) being calendered, said assembly comprising

- at least two members (1, 2; 3, 4) adapted to cooperate in a nip contact so as to pass therebetween the web (5) being calendered, and

- a gauging device (6, 7, 8) for measuring the tension of the web (5) being calendered at multiple points along the cross-machine width of the web (5);

characterized in that the calender nips (9, 10) are adapted openable when the web tension measured at a preset number of cross-machine points of the web (5) has fallen to a value at which a decision-making algorithm monitoring the tension profile of the web (5) interprets the detected situation to be caused by damaged area of the web (5) that necessitates the opening of the nips (9, 10), the decision to open the nips is made before a complete break of the web (5) occurs.

8. Assembly according to claim 7, characterized in that said gauging device (6, 7) is located at a point preceding said calender nip (9, 10) upstream in regard to the travel direction of the web (5).

- 5 9. Assembly according to claim 7 or 8, c h a r a c -
t e r i z e d in that said gauging device (8) is
located at a point after said calender nip (9, 10)
downstream in regard to the travel direction of the
web (5).
- 10 10. Assembly according to any one of claims 7-9,
c h a r a c t e r i z e d in that said gauging
device (6, 7, 8) is a gauging bar shaped to have an
at least partially arcuate surface in the travel
direction of said web (5) and has pressure sensors
adapted to holes made thereon.
- 15 11. Assembly according to any one of foregoing claims,
c h a r a c t e r i z e d in that one of the
members (1, 2; 3, 4) forming said calender nip (9,
10) is metal-surfaced roll and the other one is
soft-coated roll.
- 20 12. Assembly according to any one of foregoing claims,
c h a r a c t e r i z e d by an air-jet cutting
device adapted to perform the severing of said web
(5) being calendered at the instant the decision-
making algorithm monitoring interprets the situation
25 to be a web break or a so extensively damaged area
of the web (5) that requires the opening of the nips
(9, 10).
- 30 13. Assembly according to claim 12, c h a r a c t e r -
i z e d in that said air-jet cutting device is
integrated with said web tension gauging bar.
- 35 14. Method for detecting a break or damage occurring in
a web (5) being calendered, in which method the
machine-direction tension of the web (5) being
calendered is measured at multiple points over the
cross-machine width of the web (5), c h a r a c -

5 t e r i z e d in that a damage of the web (5) is
indicated when the measured web tension at a preset
number of points over the cross-machine width of the
web (5) has fallen to a limit value that by a
decision-making algorithm monitoring the tension
profile of the web (5) is interpreted to indicate a
damage on the web (5) requiring opening the nips (9,
10), the indication is made before a complete break
of the web (5) occurs.

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The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ SE

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION	
Applicant's or agent's file reference VAL 227 PCT	
International application No. PCT/FI00/00817	International filing date (day/month/year) (22.9.2000) 22 September 2000
(Earliest) Priority date (day/month/year) (24.9.1999) 24 September 1999	
Title of invention Method and apparatus for opening calender nips	
Box No. II APPLICANT(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) VALMET CORPORATION Fabiankatu 9 A FIN-00130 HELSINKI FINLAND	
Telephone No.	
Facsimile No.	
Teleprinter No.	
Applicant's registration No. with the Office	
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) LEPPÄKOSKI, Helena Sirukuja 6 FIN-0440 JÄRVENPÄÄ FINLAND	
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) KOIVUKUNNAS, Pekka Tupalantie 13 D 31 FIN-04400 JÄRVENPÄÄ FINLAND	
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland
<input checked="" type="checkbox"/> Further applicants are indicated on a continuation sheet.	

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet should not be included in the demand.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

HASANEN, Kari
Päivärinteentie 13 A 6
FIN-04250 KERAVA
FINLAND

State (that is, country) of nationality:
Finland

State (that is, country) of residence:
Finland

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

State (that is, country) of nationality:

State (that is, country) of residence:

☐ Further applicants are indicated on another continuation sheet.

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: (Family name followed by given name; for a legal entity, full official designation.
The address must include postal code and name of country.)SEPPO LAINE OY
Itämerenkatu 3 B
FIN-00180 HELSINKI
FINLAND

Telephone No.

+358-9-68 59 560

Facsimile No.

+358-9-68 595 610

Teleprinter No.

Agent's registration No. with the Office

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filed

the description

☐

as originally filed

☐

as amended under Article 34

the claims

☐

as originally filed

☐

as amended under Article 19 (together with any accompanying statement)

☐

as amended under Article 34

the drawings

☐

as originally filed

☐

as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). (This check-box may be marked only where the time limit under Article 19 has not yet expired.)

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English☐

which is the language in which the international application was filed.

☐

which is the language of a translation furnished for the purposes of international search.

☒

which is the language of publication of the international application.

☐

which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby elects all eligible States (that is, all States which have been designated and which are bound by Chapter II of the PCT)

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary
Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|---|--|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 5. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> original separate power of attorney | 6. <input type="checkbox"/> sequence listing in computer readable form |
| 3. <input type="checkbox"/> original general power of attorney | 7. <input type="checkbox"/> other (<i>specify</i>): |
| 4. <input type="checkbox"/> copy of general power of attorney;
reference number, if any: | |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

Seppo Laine Oy

for the Applicant


Jyrki Nissinen

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due
to CORRECTIONS under Rule 60.1(b):

- | | |
|---|---|
| 3. <input type="checkbox"/> The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. | <input type="checkbox"/> The applicant has been informed accordingly. |
|---|---|

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT REQUEST

VAL 227 PCT

Original (for SUBMISSION) - printed on 22.09.2000 08:35:12 AM

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.91 (updated 01.07.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	VAL 227 PCT
I	Title of invention	METHOD AND ASSEMBLY FOR OPENING CALENDER NIPS
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	VALMET CORPORATION
II-5	Address:	Fabianinkatu 9 A FIN-00130 Helsinki Finland
II-6	State of nationality	FI
II-7	State of residence	FI
II-8	Telephone No.	+358-20 484 100
II-9	Facsimile No.	+358-20 484 101
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	LEPPÄKOSKI, Helena
III-1-5	Address:	Sirukuja 6 FIN-04440 Järvenpää Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

PCT REQUEST

VAL 227 PCT

Original (for SUBMISSION) - printed on 22.09.2000 08:35:12 AM

III-2	Applicant and/or inventor	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	KOIVUKUNNAS, Pekka
III-2-5	Address:	Tupalantie 13 D 31 FIN-04400 Järvenpää Finland
III-2-6	State of nationality	FI
III-2-7	State of residence	FI
III-3	Applicant and/or inventor	
III-3-1	This person is:	applicant and inventor
III-3-2	Applicant for	US only
III-3-4	Name (LAST, First)	HASANEN, Kari
III-3-5	Address:	Päivärinteentie 13 A 6 FIN-04250 Kerava Finland
III-3-6	State of nationality	FI
III-3-7	State of residence	FI
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	SEPPO LAINE OY
IV-1-2	Address:	Itämerenkatu 3 B FIN-00180 Helsinki Finland
IV-1-3	Telephone No.	+358-9-68 59 560
IV-1-4	Facsimile No.	+358-9-68 595 610
IV-1-5	e-mail	seppo.laine@selpat.fi

PCT REQUEST

VAL 227 PCT

Original (for SUBMISSION) - printed on 22.09.2000 08:35:12 AM

V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</p> <p>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</p> <p>EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT</p> <p>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</p>
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AE AG AL AM AT (patent and utility model) AU AZ BA BB BG BR BY BZ CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM DZ EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</p>
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	24 September 1999 (24.09.1999)
VI-1-2	Number	19992058
VI-1-3	Country	FI

PCT REQUEST

VAL 227 PCT

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VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	9	-
VIII-3	Claims	4	-
VIII-4	Abstract	1	val227pct.txt
VIII-5	Drawings	1	-
VIII-7	TOTAL	19	
VIII-8	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-9	Separate signed power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of official action	-
VIII-18	Figure of the drawings which should accompany the abstract		
VIII-19	Language of filing of the international application	Finnish	
IX-1	Signature of applicant or agent		
IX-1-1	Name	SEPPO LAINE OY	
IX-1-2	Name of signatory	Simo Hovi	
IX-1-3	Capacity	Patent Agent	

FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

11-1	Date of receipt of the record copy by the International Bureau	
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RECORD COPY

1/4

PCT REQUEST

VAL 227 PCT

Original (for SUBMISSION) - printed on 22.09.2000 08:35:12 AM

0	For receiving Office use only	
0-1	International Application No.	PCT/FI 0 0 / 0 0 8 1 7
0-2	International Filing Date	2 2 SEP 2000 (2 2 -09- 2000)
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.91 (updated 01.07.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	VAL 227 PCT
I	Title of invention	METHOD AND ASSEMBLY FOR OPENING CALENDER NIPS
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	VALMET CORPORATION
II-5	Address:	Fabianinkatu 9 A FIN-00130 Helsinki Finland
II-6	State of nationality	FI
II-7	State of residence	FI
II-8	Telephone No.	+358-20 484 100
II-9	Facsimile No.	+358-20 484 101
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	LEPPÄKOSKI, Helena
III-1-5	Address:	Sirukuja 6 FIN-04440 Järvenpää Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

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III-2	Applicant and/or inventor	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	KOIVUKUNNAS, Pekka
III-2-5	Address:	Tupalantie 13 D 31 FIN-04400 Järvenpää Finland
III-2-6	State of nationality	FI
III-2-7	State of residence	FI
III-3	Applicant and/or inventor	
III-3-1	This person is:	applicant and inventor
III-3-2	Applicant for	US only
III-3-4	Name (LAST, First)	HASANEN, Kari
III-3-5	Address:	Päivärinteentie 13 A 6 FIN-04250 Kerava Finland
III-3-6	State of nationality	FI
III-3-7	State of residence	FI
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	SEPPO LAINE OY
IV-1-2	Address:	Itämerenkatu 3 B FIN-00180 Helsinki Finland
IV-1-3	Telephone No.	+358-9-68 59 560
IV-1-4	Facsimile No.	+358-9-68 595 610
IV-1-5	e-mail	seppo.laine@selpat.fi

PCT REQUEST

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V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</p> <p>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</p> <p>EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT</p> <p>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</p>
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	<p>AE AG AL AM AT (patent and utility model) AU AZ BA BB BG BR BY BZ CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM DZ EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</p>
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	24 September 1999 (24.09.1999)
VI-1-2	Number	19992058
VI-1-3	Country	FI

PCT REQUEST

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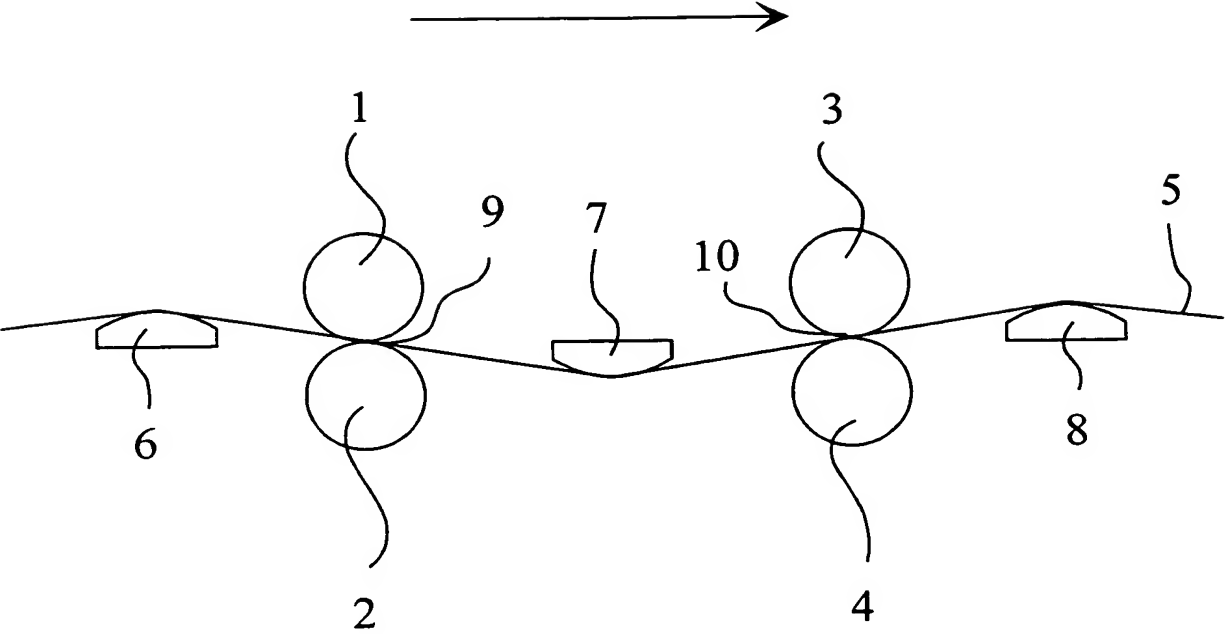
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
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VIII-3	Claims	4	-
VIII-4	Abstract	1	val227pct.txt
VIII-5	Drawings	1	-
VIII-7	TOTAL	19	
	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-9	Separate signed power of attorney	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of official action	-
VIII-18	Figure of the drawings which should accompany the abstract		
VIII-19	Language of filing of the international application	Finnish	
IX-1	Signature of applicant or agent		
IX-1-1	Name	SEPPO LAINE OY	
IX-1-2	Name of signatory	Simo Hovi	
IX-1-3	Capacity	Patent Agent	

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10-1	Date of actual receipt of the purported international application	2 2 SEP 2000	(2 2 -09- 2000)
10-2	Drawings:		
10-2-1	Received		
10-2-2	Not received		
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application		
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)		
10-5	International Searching Authority	ISA/SE	
10-6	Transmittal of search copy delayed until search fee is paid		

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11-1	Date of receipt of the record copy by the International Bureau	0 6 OCT. 2000	(0 6. 10. 00)
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Menetelmä ja sovitelma kalanterin nippien avaamiseksi

Tämän keksinnön kohteina ovat patenttivaatimuksen 1 johdannon mukainen menetelmä ja patenttivaatimuksen 7 johdannon mukainen sovitelma kalanterin nippien avaamiseksi erityisesti kalanteroitavan rainan katketessa. Keksinnön kohteena on myös patenttivaatimuksen 14 johdannon mukainen menetelmä liikkuvan rainan ratakatkon havaitsemiseksi.

10 Paperi- tai kartonkirainan pintaa tasoitetaan ja kiillotetaan kalanterissa, jossa on päällekkäin kalanterin runkoon kiinnitettyjä teloja, jotka ovat nippikosketuksessa keskenään. Monitelakalanterissa on ylä- ja alatela sekä ainakin yksi näiden väliin sijoitettu välitela. Telaryhmä puristetaan kokoon kuormitusteloina toimivilla ylä- ja alateloilla riittävän nippikuorman aikaansaamiseksi. Kalanteroitava raina kulkee päällekkäisten telojen muodostamien kalanterinippien läpi. Soft-kalanterissa on tyypillisesti kaksi tai neljä nippiä, jotka on sijoitettu peräkkäin eri runkosiin, jolloin kalanteroitava raina kulkee nippien välissä yleensä suoraviivaisesti. Perinteisessä kaksinippisessä soft-kalanterissa raina kalanteroidaan kerran molemmilta puolilta.

25 Osa kalantereiden teloista on lämmitettäviä, kovapintaisia termoteloja ja osa pehmeällä pinnoitteella varustettuja teloja. Esimerkiksi soft-kalanterissa nipin muodostavan telaparin teloista toinen on yleensä metallipintainen termotela ja toinen pehmeällä pinnoitteella varustettu tela. Termotela lämmitetään yleensä öljyllä tai muulla sopivalla lämmönsiirtoaineella, kuten vedellä tai höyryllä. Kun lämmitämisessä käytetään öljyä, voidaan päästä jopa lähes 300 °C:n lämpötilaan saakka. Tyypillisesti termotelan lämpötila

Pehmeällä pinnoitteella varustettujen telojen materiaalinvalinnassa on otettava huomioon mahdollisesti lähellä olevan termotelan aiheuttama lämmön nousu. Pehmeäpintaisten telojen pinnoitteet on valmistettu nippiolosuhteet kestävästä materiaalista, kuten nykyisin yleisesti käytettävästä polymeristä, esimerkiksi kesto- tai kertamuovista. Kestomuovilla pinnoitettuja teloja on kuvattu mm. julkaisussa GB 1 011 114 ja kertamuovilla pinnoitettuja teloja mm. julkaisussa EP 321 561. Aiemmin pehmeäpintaisten telojen pinnoitteet olivat yleensä luonnonkuiduista valmistettuja materiaaleja, joita on kuvattu mm. julkaisussa US 4 283 821.

Toisinaan kalanteroitava raina katkeaa kalanteroitaessa, ennen kalanterointia tai kalanteroinnin jälkeen, jolloin kalanterin nipit on avattava mahdollisimman nopeasti ratakatkon tapahduttua. Erityisen tärkeää nippien avaaminen on kalantereissa, joissa on pehmeällä pinnoitteella varustettuja teloja. Nippien ollessa suljettuna termotelat alkavat ratakatkon tapahduttua kuumentaa pehmeällä pinnoitteella varustettuja teloja, koska paperiraina ei enää kuljeta termoteloista tulevaa lämpöä nipeistä pois. Tällöin pehmeäpin-
taiset telat saattavat kuumeta liikaa ja vahingoittua. Ny-
kyaikaisissa kalantereissa, joissa ajonopeudet ovat suuria, ovat myös termoteloilla nippeihin tuotavat lämpömäärät suu-
ria, minkä takia nippi on avattava erittäin nopeasti, jopa

sekunnin kymmenesosissa, jos ratakatko tapahtuu juuri ennen nippiä.

5 Pehmeäpintaisten telojen vahingoittumisen estämiseksi kalanterit varustetaan ratakatkoautomaatiikalla, joka avaa kalanterin nipit välittömästi ratakatkon tapahduttua. Ratakatkoja tutkitaan yleensä rainan poikkisuuntaan asetettujen valokennojen avulla. Koska mahdollinen ratakatko on havaittava nopeasti, ei valokennoilta tulevaa signaalia pystytä
10 suodattamaan riittävästi. Tällöin rainassa oleva pieni virhe, kuten reikä, saatetaan tulkita ratakatkoksi, vaikka todellisuudessa vahingoittunut rainan kohta menisi kalanterin läpi ilman ongelmia. Pehmeäpintaisten telojen korkean hinnan takia nipit asetetaan yleensä avautumaan pientenkin
15 virheiden takia. Virheellisen tulkinnan tai liian herkäksi asetetun ratakatkoautomaatiikan seurauksena on kalanterin nippien avautuminen, jolloin kalanteroitava raina vasta todellisuudessa katkeaa.

20 Tämän keksinnön tarkoituksena on poistaa edellä kuvatun tekniikan puutteellisuudet ja saada aikaan aivan uudenlainen menetelmä ja sovitelma, joilla kalanteroitavan rainan nipit avataan kalanteroitavan rainan katketessa tai vahingoittuessa. Lisäksi keksinnön tarkoituksena on aikaansaada
25 aivan uudenlainen menetelmä liikkuvan rainan ratakatkon havaitsemiseksi.

Keksintö perustuu siihen, että mitataan kalanteroitavan rainan kireysprofiilia useasta rainan poikittaissuuntaisesta kohdasta, jolloin sopivan mittaussignaalin käsittelyn
30 avulla voidaan päätellä onko kyseessä todellinen, nippien avaamista vaativa ratakatko tai vahingoittunut rainan kohta vai pienempi vika, jonka pitäisi mennä kalanterista läpi

ilman suuria ongelmia. Rainan kireysprofiilia voidaan mitata esimerkiksi siten, että ohjataan liikkuva raina kulkemaan kaarevan kireydenmittauslistan päältä. Kireydenmittauslistassa on reikiä, joihin on asetettu listan yli liikkuvan rainan ja listan väliin muodostuvan ilmatyynyn paikallista painetta mittaavia antureita. Ilmatyynyn paine on suoraan verrannollinen rainan kireyteen kyseisessä kohdassa. Kalanterin nipit avataan, kun halutussa määrässä rainan poikittaissuuntaisia kohtia mitattu kireys on laskenut arvoon, jossa rainan kireysprofiilia tarkkaileva päättelyalgoritmi tulkitsee tilanteen ratakatkoksi tai nippien avaamista vaativaksi vahingoittuneeksi rainan kohdaksi. Rainan kireyttä voidaan mitata esimerkiksi ennen kalanteria, kalanterin jälkeen tai kahden nipin välillä.

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Täsmällisemmin sanottuna keksinnön mukaiselle menetelmälle kalanterin nippien avaamiseksi on tunnusomaista se, mikä on esitetty patenttivaatimuksen 1 tunnusmerkkiosassa.

20 Keksinnön mukaiselle sovitelmalle kalanterin nippien avaamiseksi on tunnusomaista se, mikä on esitetty patenttivaatimuksen 7 tunnusmerkkiosassa.

Keksinnön mukaiselle menetelmälle liikkuvan rainan ratakatkojen havaitsemiseksi puolestaan on tunnusomaista se, mikä on esitetty patenttivaatimuksen 14 tunnusmerkkiosassa.

Keksinnön avulla saavutetaan huomattavia etuja.

30 Kalanteroitavan rainan poikittaissuuntaista kireysprofiilia mittaamalla voidaan ratakatkot ja rainan suuremmat viat erottaa huomattavasti valokennojen käyttöön perustuvaa mitausta luotettavammin sellaisista vioista, joiden pitäisi

mennä kalanterista läpi ilman ongelmia. Samalla mittaustulosten väärän tulkinnan aiheuttamat ratakatkot vähenevät, mikä parantaa kalanterin käytettävyyttä ja vähentää hukkaan menevän tuotannon määrää. Keksinnön mukaisessa ratkaisussa
5 voidaan optimoida rainassa olevan vahingoittuneen alueen koko ja tätä vastaava kireysprofiili, jolla kalanteroitava raina voidaan vielä ajaa kalanterin läpi ilman suuria vaikeuksia. Lisäksi vahingoittunut rainan kohta voidaan havaita kireysprofiilia mittaamalla jo ennen sen saapumista kalanterille, jolloin nipit ehditään varmemmin avata ennen
10 kuin pehmeäpintaisten telat vahingoittuvat. Keksinnön mukainen ratkaisu on helposti sovitettavissa eri paperilaaduille, koska arvoja, joissa kalanterin nipit avataan, voidaan helposti muuttaa. Kireysprofiilia mittaava laitteisto on
15 myös rakenteeltaan melko yksinkertainen ja helposti asennettavissa kalanterin yhteyteen.

Keksintöä kuvataan seuraavassa tarkemmin viittaamalla oheiseen piirustukseen, joka esittää kaaviollisesti kaksinip-
20 pistä kalanteria.

Piirustuksen mukainen kalanteri käsittää kaksi nippiä 9, 10, jotka muodostuvat nippikosketukseen sovitetuista elimistä, kuten teloista ja/tai kenkäkalanterin kengistä. Piirustuksen sovellusmuodossa nipin 9 muodostavat telat 1, 2 ja nipin 10 telat 3, 4. Tyypillisesti toinen nipin 9, 10 muodostavista teloista 1-4 on kovapintainen, öljyllä, höyryllä tai vedellä lämmitettävä termotela ja toinen pehmeällä pinnoitteella varustettu tela. Perinteisessä kaksinippisessä kalanterissa raina 5 pidetään nippien 9, 10 välissä
25 lähes suorana. Rainan 5 leveys kasvaa siihen kohdistettavan puristuksen vaikutuksesta ensimmäisessä nipissä 9, minkä takia nippien 9, 10 väliin on tavallisesti sijoitettu ohja-
30

us- ja levitysteloja, joilla rainaa 5 levitetään ja kiristetään. Yleensä soft-kalanterin telat 1-4 on järjestetty siten, että nippien 9, 10 läpi kulkeva raina 5 kalanteroidaan molemmilta puoliltaan, jolloin ensimmäisen nipin 9 kova- ja pehmeäpintainen tela 1, 2 ovat eri järjestyksessä kuin toisen nipin 10 telat 3, 4. Rainan 5 kulkusuunta on merkitty piirustukseen nuolella.

Kalanteroitavan rainan 5 kulkusuunnassa ennen ensimmäistä nippiä 9 olevaan kohtaan on sijoitettu rainan 5 poikittaissuuntaista kireyttä mittaava laite 6. Vastaavanlainen laite 7, 8 on sijoitettu myös nipin 9 ja nipin 10 väliseen kohtaan sekä rainan 5 kulkusuunnassa nipin 10 jälkeiseen kohtaan. Mittalaite voidaan myös sijoittaa ainoastaan yhteen tai kahteen edellä kuvatuista paikoista, edullisesti mittalaite on kuitenkin sijoitettu rainan 5 kulkusuunnassa ennen nippejä 9, 10.

Kalanteroitavan rainan kireysprofiilia mittaava laite 6, 7, 8 voi olla esimerkiksi kaareva mittalista, jossa on rivissä oleellisesti poikittain rainan 5 kulkusuuntaan nähden sijoitettuja aukkoja, joihin kuhunkin on sijoitettu paineanturi. Kalanteroitava raina 5 kulkee mittauslistan 6, 7, 8 yli ilmatyynyn varassa, joka muodostuu, kun rainan 5 mukanaan kuljettama ilma puristuu mittauslistan 6, 7, 8 ja rainan 5 väliin. Rainan 5 poikittaissuuntainen kireysprofiili voidaan määrittää mittaamalla rainan 5 ja mittalistan 6, 7, 8 kaarevan osan välissä olevan ilmatyynyn paikallista painetta mittalistan 6, 7, 8 aukkoihin sijoitetuilla paineantureilla. Kohdissa, joissa raina 5 on poikki tai rainassa 5 on reikä, ei luonnollisesti myöskään muodostu ilmatyynyä tai ilmatyynyn paine on pienempi kuin ehjässä kohtaa rainaa 5. Yhden tällaisen mittauslistan 6, 7, 8 rakennetta on ku-

vattu tarkemmin esimerkiksi patenttijulkaisussa US 5 052 233.

5 Kalanterin nipit 9, 10 avataan, kun halutussa määrässä rainan 5 poikittaissuuntaisia kohtia mitattu kireys on laske-
nut arvoon, jossa rainan 5 kireysprofiilia tarkkaileva
päättelyalgoritmi tulkitsee tilanteen ratakatkoksi tai nip-
pien 9, 10 avaamista vaativaksi vahingoittuneeksi rainan 5
kohdaksi. Rainan 5 poikittaissuuntaisella kohdalla tarkoi-
10 tetaan esimerkiksi yksittäisen mittauselimen mittausaluetta
tai muuten rajattua osaa rainan 5 leveydestä. Nippien 9, 10
avaustarpeen päättelyssä ei kannata odottaa, että lähes ko-
ko raina 5 näyttää olevan poikki, vaan yleensä riittää, et-
tä niin iso alue näyttää olevan vahingoittunut, ettei ha-
15 vaintoa saa aikaan rainassa 5 oleva pieni reikä tai rikki-
näinen rainan 5 reuna.

Edellä kuvatun menetelmän päättelyalgoritmi voidaan esimer-
kiksi muodostaa siten, että rainan 5 poikittaissuuntaiselle
20 kireydelle annetaan haluttu vertailuarvo, johon mittalait-
teella 6, 7, 8 mitattua kireysarvoa verrataan. Rainan 5
niiden kohtien leveydet, joiden mitattu kireysarvo alittaa
annetun vertailuarvon, lasketaan yhteen. Tämän jälkeen ki-
reyden vertailuarvon alittavien rainan 5 kohtien yhteenlas-
25 kettua leveyttä verrataan koko rainan 5 leveyteen, jolloin
näiden suhteen ylittäessä halutun, muutettavissa olevan ra-
ja-arvon, kalanterin nipit 9, 10 avataan. Vertailuarvon
alittavien rainan 5 kohtiin yhteenlaskettu leveys on ver-
rannollinen rainan 5 vahingoittuneen kohdan leveyteen. Esi-
30 merkiksi kalanteroitavan rainan 5 ollessa kokonaan poikki,
mitattu kireysarvo on pienempi kuin vertailuarvo ainakin
likimain koko rainan 5 leveydellä. Vertailuarvo ja raja-
arvo eli vahingoittuneiden kohtien yhteenlasketun leveyden

suhde rainan 5 kokonaisleveyteen, jolla raina 5 vielä menee kalanterista läpi ilman ongelmia, voidaan määrittää esimerkiksi kokemusperäisesti. Kullakin paperilaadulla on yleensä käytettävä omia vertailu- ja raja-arvoja. Vertailu- ja raja-arvojen asetusta voidaan luonnollisesti muuttaa esimerkiksi kalanteroitavan paperin ominaisuuksien vaihtuessa.

Toinen tapa muodostaa päättelyalgoritmi on laskea erillisten kireyden mittauskohtien mittausarvoista esimerkiksi painotettu keskiarvo, ja avataan kalanterin nipit 9, 10, kun tämä arvo alittaa annetun vertailuarvon. Painokerroin on tyypillisesti verrannollinen kyseisen mittauskohdan leveyteen.

Päättelyalgoritmi voidaan myös toteuttaa edellä kuvattuja tapoja älykkäämmin, esimerkiksi tilastolliseen käsittelyyn perustuvan mallin avulla, joka esimerkiksi huomio normaaliin kireysvaihteluiden suuruuden ja päättää ratakatkon sen perusteella, että rainan 5 kireydet putoavat merkittävästi enemmän kuin normaalin kireysmittauksen satunnaiseen vaihteluun verraten on todennäköistä.

Keksinnön mukainen menetelmä liikkuvan rainan 5 ratakatkon havaitsemiseksi on muuten vastaava kuin edellä kuvattu menetelmä kalanterin nippien avaamiseksi, mutta siinä ilmoitetaan ratakatkosta, kun rainan 5 niiden kohtien yhteenlaskettu leveys, joissa rainan 5 mitattu kireysarvo alittaa annetun vertailuarvon, on ainakin likimain yhtäsuuri kuin koko rainan 5 leveys.

Keksinnöllä on myös edellä esitetystä poikkeavia sovellusmuotoja.

Vaikka edellä esitettyä kireydenmittauslistan avulla tapahtuvaa kalanteroitavan rainan poikittaissuuntaisen kireysprofiilin määrittämiseen perustuvaa ratkaisua voidaan pitää keksinnön edullisimpana suoritusmuotona, voidaan rainan kireysprofiili määrittää myös muilla tarkoitukseen soveltuvilla laitteilla. Yksi tällainen on kireydenmittaustela, joka on jaettu segmentteihin, joihin rainan ja telan välillä olevan ilmatyynyn painetta mittaavat anturit on sijoitettu.

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Monitelakalantereissa, joissa on päällekkäisten telojen muodostamia nippejä, rainan kireysprofiilin mittalaitetta on vaikea sovittaa kalanterin nippien väliin, minkä takia kalanteroitavan rainan poikittaissuuntaisen kireysprofiilin mittaaminen on suoritettava ennen kalanteria ja/tai sen jälkeen.

15

Päättelyalgoritmin havaittua ratakatkon tai nippien avaamista vaativan vahingoittuneen rainan kohdan, voidaan rainan katkaisuun käyttää ilmakatkaisulaitetta, joka katkaisee rainan paineilmasuihkun avulla. Ilmakatkaisun avulla katkaistu raina voidaan ohjata nopeasti pois päin, jolloin se ei kietoudu telojen ympärille. Lisäksi ilmakatkaisu on huomattavasti turvallisempi kuin esimerkiksi leikkaavilla terillä tapahtuva katkaisu. Ilmakatkaisulaite voidaan esimerkiksi integroida edellä kuvattuun kireydenmittauslistaan.

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Patenttivaatimukset:

1. Menetelmä sellaisen kalanterin nippien (9, 10) avaami-
seksi, joka käsittää ainakin kaksi nippikosketukseen so-
vitettua elintä (1, 2; 3, 4), erityisesti kalanteroitava-
van rainan (5) katketessa tai vahingoittuessa, jossa me-
netelmässä mitataan kalanteroitavan rainan (5) kireyttä
useasta rainan (5) poikittaissuuntaisesta kohdasta,
tunnettu siitä, että avataan kalanterin nipit (9,
10), kun halutussa määrässä rainan (5) poikittaissuun-
taisia kohtia mitattu kireys on laskenut arvoon, jossa
rainan (5) kireysprofiilia tarkkaileva päättelyalgoritmi
tulkitsee tilanteen ratakatkoksi tai nippien (9, 10)
avaamista vaativaksi vahingoittuneeksi rainan (5) koh-
daksi.
2. Patenttivaatimuksen 1 mukainen menetelmä, tunnettu
sitä, että
- annetaan rainan (5) kireydelle haluttu ver-
tailuarvo kireyden mittauskohdassa,
 - verrataan mitattua rainan (5) kireysarvoa
vertailuarvoon, ja
 - avataan kalanterin nipit (9, 10), kun rainan
(5) niiden poikittaissuuntaisten kohtien yh-
teenlasketun leveyden suhde, joissa rainan
(5) mitattu kireysarvo alittaa annetun ver-
tailuarvon, koko rainan (5) leveyteen ylit-
tää halutun raja-arvon.

3. Patenttivaatimuksen 1 mukainen menetelmä, tunnettu siitä, että

- 5 - annetaan rainan (5) kireydelle haluttu vertailuarvo kireyden mittauskohdassa,
- lasketaan rainan (5) eri kohdista mitattujen kireysarvojen painotettu keskiarvo, ja
- 10 - avataan kalanterin nipit (9, 10), kun kireysarvojen painotettu keskiarvo alittaa annetun vertailuarvon.

15 4. Patenttivaatimuksen 3 mukainen menetelmä, tunnettu siitä, että painotetun keskiarvon painokertoimena käytetään mittauskohdan leveyttä.

20 5. Jonkin edellä olevan patenttivaatimuksen mukainen menetelmä, tunnettu siitä, että mitataan kalanteroitavan rainan (5) kireyttä epäsuorasti mittaamalla rainan (5) läheisyyteen sijoitetun, rainan (5) kulkusuunnassa ainakin osittain kaarevan pinnan omaavan mittauslistan ja liikkuvan rainan (5) väliin muodostuvan ilmapatjan paine, joka on verrannollinen rainan (5) kireyteen.

25 6. Jonkin edellä olevan patenttivaatimuksen mukainen menetelmä, tunnettu siitä, että katkaistaan kalanteroitava raina (5) ilmakatkaisulaitteella, kun rainan (5) kireysprofiilia tarkkaileva päättelyalgoritmi tulkitsee
30 tilanteen ratakatkoksi tai nippien (9, 10) avaamista vaativaksi vahingoittuneeksi rainan (5) kohdaksi.

7. Sovitelma kalanterin nippien (9, 10) avaamiseksi erityisesti kalanteroitavan rainan (5) katketessa tai vahingoittuessa, joka sovitelma käsittää

5 - ainakin kaksi nippikosketukseen sovitettua elintä (1, 2; 3, 4), joiden välistä kalanteroitava raina (5) on sovitettu kulkemaan, ja

10 - mittalaitteen (6, 7, 8) kalanteroitavan rainan (5) kireyden mittaamiseksi useasta rainan (5) poikittaissuuntaisesta kohdasta,

15 tunnettu siitä, että kalanterin nipit (9, 10) on sovitettu avattaviksi, kun halutussa määrässä rainan (5) poikittaissuuntaisia kohtia mitattu kireys on laskenut arvoon, jossa rainan (5) kireysprofiilia tarkkaileva

20 päättelyalgoritmi tulkitsee tilanteen ratakatkoksi tai nippien (9, 10) avaamista vaativaksi vahingoittuneeksi rainan (5) kohdaksi.

20

8. Patenttivaatimuksen 7 mukainen sovitelma, tunnettu siitä, että mittalaite (6, 7) on sovitettu rainan (5) kulkusuunnassa ennen kalanterin nippiä (9, 10) olevaan kohtaan.

25

9. Patenttivaatimuksen 7 tai 8 mukainen sovitelma, tunnettu siitä, että mittalaite (8) on sovitettu rainan (5) kulkusuunnassa kalanterin viimeisen nipin (10) jälkeiseen kohtaan.

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10. Jonkin patenttivaatimuksen 7-9 mukainen sovitelma, tunnettu siitä, että mittalaite (6, 7, 8) on rainan (5) kulkusuunnassa ainakin osittain kaarevan pinnan

omaava kireydenmittauslista, jossa on reikiin sovitettuja paineenmittausantureita.

11. Jonkin edellä olevan patenttivaatimuksen mukainen sovitelma, tunnettu siitä, että toinen kalanterin nipin (9, 10) muodostavista elimistä (1, 2; 3, 4) on metallipintainen tela ja toinen pehmeällä pinnoitteella varustettu tela.
12. Jonkin edellä olevan patenttivaatimuksen mukainen sovitelma, tunnettu ilmakatkaisulaitteesta, jolla kalanteroitava raina (5) on sovitettu katkaistavaksi, kun rainan (5) kireysprofiilia tarkkaileva päättelyalgoritmi tulkitsee tilanteen ratakatkoksi tai nippien (9, 10) avaamista vaativaksi vahingoittuneeksi rainan (5) kohdaksi.
13. Patenttivaatimuksen 12 mukainen sovitelma, tunnettu siitä, että ilmakatkaisulaite on integroitu kireydenmittauslistaan.
14. Menetelmä liikkuvan rainan (5) ratakatkon tai vahingoittumisen havaitsemiseksi, jossa menetelmässä mitataan rainan (5) kireyttä useasta rainan (5) poikittaissuuntaisesta kohdasta, tunnettu siitä, että ilmoitetaan rainan (5) ratakatkosta tai vahingoittumisesta, kun halutussa määrässä rainan (5) poikittaissuuntaisia kohtia mitattu kireys on laskenut arvoon, jossa rainan (5) kireysprofiilia tarkkaileva päättelyalgoritmi tulkitsee tilanteen ratakatkoksi tai nippien (9, 10) avaamista vaativaksi vahingoittuneeksi rainan (5) kohdaksi.

Tiivistelmä (57):

Keksinnön kohteina ovat menetelmä ja sovitelma sellaisen kalanterin nippien (9, 10) avaamiseksi, joka käsittää ainakin kaksi nippikosketukseen sovitettua elintä (1, 2; 3, 4), erityisesti kalanteroitavan rainan (5) katketessa tai vahingoittuessa. Kalanteroitavan rainan (5) kireyttä mitataan useasta rainan (5) poikittaissuuntaisesta kohdasta ja kalanterin nipit (9, 10) avataan, kun halutussa määrässä rainan (5) poikittaissuuntaisia kohtia mitattu kireys on laskenut arvoon, jossa rainan (5) kireysprofiilia tarkkaileva päättelyalgoritmi tulkitsee tilanteen ratakatkoksi tai nippien (9, 10) avaamista vaativaksi vahingoittuneeksi rainan (5) kohdaksi.
